CURRICULUM VITAE OF QUANLIN ZHOU 06/2014

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1. EDUCATION AND DEGREES

1996 – 1999	Ph.D. in Civil & Environmental Engineering Technion-Israel Institute of Technology, Haifa, Israel
1987 – 1990	M. Eng. in Hydrology and Water Resources Hohai University, Nanjing, China.
1983 – 1987	B. Eng. in Hydrology and Water Resources Hohai University, Nanjing, China

2. EMPLOYMENT HISTORY

01/20012 – Present	Geological Staff Scientist (Career)
11/2008 – 12/2011	Geological Research Scientist (Career)
06/2006 – 10/2008 09/2002 – 06/2005	Geological Research Scientist (Career-Track)
03/2001 – 09/2002	Geological Postdoctoral Fellow Earth Sciences Division Lawrence Berkeley National Laboratory (LBNL) 1 Cyclotron Road, MS 74-316C, Berkeley, CA 94720
06/2005 – 06/2006	Senior Modeler, ETIC Engineering Inc. 1333 Broadway, Suite 1015, Oakland, CA 94612
10/2000 – 03/2001	Postdoctoral Fellow, Department of Geology & Geophysics University of Wisconsin at Madison 1215 W. Dayton Street, Madison, WI53706
10/1999 – 09/2000	Postdoctoral Associate Department of Civil & Environmental Engineering, MIT 15 Vassar Street, Cambridge, MA 02139
10/1995 – 10/1996 07/1990 – 10/1995	Senior Engineer Engineer Nanjing Institute of Hydrology and Water Resources Ministry of Water Resources, Nanjing, China

3. RESEARCH EXPERIENCE

3.1 Research Interests:

- Analytical and numerical modeling of flow and contaminant transport in fractured/porous media for nuclear waste disposal, geologic carbon sequestration, and site-specific contamination remediation
- Multiphase and unsaturated flow in heterogeneous fractured/porous media; preferential flow, lateral spreading, upscaling and effective properties
- Geologic carbon sequestration: pressure buildup and brine migration and their impact on groundwater resources at basin scale; enhanced storage capacity and safety in natural hierarchical, multiscale, heterogeneous sedimentary rocks at plume scale; early leakage detection by joint inversion of reservoir/overburden pressure and land surface uplift
- Diffusive transport in fractured rock and layered porous media at small and field scales; behavior of field-scale effective diffusion coefficient for heterogeneous media; effective diffusion in unsaturated and multiphase flow conditions
- Characterization of large-scale contaminant plumes, with physical, chemical, microbial (biodegradation) processes; conceptual understanding with detailed data and inverse analysis in support of on-site remediation and natural attenuation
- Density-dependent flow for seawater intrusion and brine transport

3.2 Research Proposals Funded (Total Funds: $11.2M, Total Funds as PI and Co-PI: $10.9M)

Projects for Geologic Carbon Sequestration (FY2008 – FY2018) (Total Funding: $11.0M)

1. Multiscale modeling of CO_2 migration and trapping in fractured reservoirs with validation by model comparison and real-site applications (FY15-FY17, PI, LBNL share of **$200K**, total project **$**1,000K led by Prof. Mike Celia at Princeton University, funded by USDOE)
2. Modeling and monitoring support of the Big Sky Partnership's Phase III project at Kevin Dome (FY2011 – FY2018, Co-PI with Curtis Oldenburg, and Task Lead for modeling, **$5,560K** funded by USDOE)
3. Stochastic Joint Inversion for CO_2 Storage Modeling and Monitoring (FY13-FY14, PI, **$245K** funded by USDOE)
4. An Advanced Joint Inversion System for CO_2 Storage Modeling with Large Data Sets for Characterization and Real-Time Monitoring — Enhancing Storage Performance and Reducing Failure Risks under Uncertainties (FY13-FY15, PI, LBNL share of **$200K**, total project **$**1,000K led by Prof. Peter Kitanidis at Stanford University, funded by USDOE)
5. Experimental studies of supercritical CO_2 dissolution and its influence on drainage and imbibition using pore-scale micromodels (FY14, PI, free use of EMSL user facility, selected by Environmental Molecular Sciences Laboratory at PNNL)
6. Large-scale hydrologic impacts of CO_2 geological storage (FY10 – FY13, Co-PI with Jens Birkholzer, **$1,391K** funded by USDOE) ($375K in FY10 + $386K in FY11 + $380K in FY12 + $250K in FY13) (Completed)

7. Validation of models simulating capillary and dissolution trapping during injection and post-injection of CO_2 in heterogeneous geological formations using data from intermediate scale test systems (FY2011 – FY2013, $600K funded by USDOE, LBNL share of **$150K**) (Completed)
8. Joint inversion of monitoring data for early leakage detection (FY10 – FY13, Co-PI with Michael Kowalsky, **$2,000K** funded by USDOE) (Completed)
9. Potential impacts of future geological storage of CO_2 on the groundwater resources in California's Central Valley (September 2010 – May 2013, Co-PI with Preston Jordan, **$490K** funded by California Energy Commission, CEC) (Completed)
10. Collaboration with China on geologic carbon sequestration: Novel field tests to characterize heterogeneity for China's first pilot test (FY2011 – FY2012, PI, **$315K**, LDRD, funded by Lawrence Berkeley National Laboratory) (Completed)
11. Analytical and numerical modeling in support of EPA Area-of-Review estimates and geologic sequestration modeling framework (2008-2012, PI, a total of **$447.5K** funded by USEPA) ($75K in 2008 + $160K in 2010 + $212.5K in 2011) (Completed)

Other Projects (2007-2009) (Total Funding: $242K)

12. Coupling state-of-the-science subsurface simulation with advanced user interface and parallel visualization (2007, PI, $100K funded by DOE Office of Science, LBNL share: **$32K**)
13. Photo- and bio-degradation of N-nitrosodimethylamine (NDMA) in a coupled surface water and groundwater system in Montebello Forebay, California (2007, PI, **$50K** funded by Los Angeles County of Sanitation Districts)
14. Mobility of tritium in engineered and earth materials at the NuMI facility, Fermilab, Phase II (2007-2009, **$160K** funded by Fermi National Accelerator Laboratory, PI: Stefan Finsterle)

3.3 Previous Research Projects:

- Large-scale hydrological evaluation and modeling of the impact of CO_2 geological sequestration on groundwater systems (Completed at LBNL, FY2007-FY2009, $900K)
- Calibration of unsaturated zone properties for the Yucca Mountain Project, with the resultant ANL-NBS-HS-000058 Rev 00 report (completed at LBNL, 2007)
- Dissolved TCE transport in a weathered, fractured rock zone at Charlotte, North Carolina: evidence of back diffusion from matrix to fractures from remediation of a long-term TCE plume (completed at ETIC, 2006)
- Scale-dependence of field-scale, effective matrix diffusion coefficient in fractured media: enhanced retardation of solute/radionuclide transport (completed at LBNL, 2005)
- Investigation of flow focusing in heterogeneous fractured rock at Yucca Mountain, Nevada (completed at LBNL, 2004)
- Analysis of fracture-informed spatial variability of infiltration and seepage in fractured rock at Yucca Mountain, Nevada (completed at LBNL, 2004)
- Pretest prediction for the Alcove 8–Niche 3 field seepage and tracer tests conducted in two tunnels at Yucca Mountain, Nevada (completed at LBNL, 2003)

- Modeling groundwater flow and advective transport at the contaminated LBNL site in support of on-site remediation (completed at LBNL, 2003)
- International co-operative project for the development of coupled thermo-hydro-mechanical (THM) models and their validation against experiments in nuclear waste isolation (DECOVALEX) (completed at LBNL, 2002)
- Effects of multiscale heterogeneity of hydrogeologic properties on unsaturated flow and transport in fractured rock at Yucca Mountain, Nevada (completed at LBNL, 2001)
- Effective properties of multiphase flow in heterogeneous porous media (completed at MIT, 2000)
- Modeling of seawater intrusion in coastal aquifers (completed at Technion,1996-1999)
- Modeling of strongly coupled density-dependent flow and salt transport (completed at Technion, 1996-1999)
- Real-time control of main canal and optimal operation of water supply and distribution in the Middle Route of the South-To-North Water Transfer Project (SNWTP-MR) (completed in China, 1995-1996)
- Risk analysis of flood control benefits of the Three-Gorge Project (completed in China, 1991)

4. AWARDS AND PROFESSIONAL SOCIETIES

- "Director's Award for Exceptional Achievement," Lawrence Berkeley National Laboratory, 2012
- "Outstanding Performance Award," Lawrence Berkeley National Laboratory, 2007
- "The Miriam and Aaron Gutwirth Award," the Gutwirth Foundation, Israel, 1999
- "The Irmay Prize," Department of Civil Engineering, Technion-Israel Institute of Technology, Haifa, Israel, 1998
- Supervisor of two postdoctoral fellows, one project scientist, and two visiting PhD students
- An international member of the Steering Committee of the CO2CARE (CO2 Site Closure Assessment Research) Consortium of multiple institutions in EU.
- A member representing LBNL, a partner of the board of associated parties (BAP) of the PANACEA consortium and MUSTANG consortium in EU.

5. SCIENTIFIC AND PROFESSIONAL PUBLICATIONS

5.1 Peer-Reviewed Journal Publications [Total SCI Citations: 607]

J1. Agartan, E., L. Trevisan, A. Cihan, J. Birkholzer, **Q. Zhou**, and T. H. Illangasekare, 2014. Contribution of convective mixing to the trapping of dissolved CO2 in deep geologic formations - Part 1: Experimental analysis, *Water Resources Research* (submitted)

J2. Trevisan, A. Cihan, E. Agartan, H. Mori, F. Fagerlund, J.T. Birkholzer, **Q. Zhou**, and T. H. Illangasekare, 2014. Investigation of mechanisms of supercritical CO_2 trapping in deep saline reservoirs using surrogate fluids at ambient laboratory conditions, *International Journal of Greenhouse Gas Control* (submitted).

J3. Akber Hassan, W.A., X. Jiang, **Q. Zhou**, C. Moulinec, and D. Emerson, 2014. A three-dimensional numerical simulation of geological carbon storage in stratified systems, *Applied Energy* (submitted).

J4. Wang, Y., M. Hu, **Q. Zhou**, and J. Rutqvist, 2014a. A new second-order numerical manifold method model with an efficient scheme for analyzing free surface flow with inner drains, *Applied Mathematical Modeling* (submitted).

J5. Jung, Y., **Q. Zhou**, and J.T. Birkholzer, 2014. On the detection of leakage pathways in geological CO_2 storage systems using pressure monitoring data: Impact of model uncertainties, *Advances in Water Resources* (in revision).

J6. Chang, C., **Q. Zhou**, Q. Yu, 2014. Behavior of CO_2 dissolution and mass transfer: Effect of CO_2 concentration in water-flood experiments, *International Journal of Greenhouse Gas Control* (accepted).

J7. Wang, Y., M. Hu, **Q. Zhou**, and J. Rutqvist, 2014b. Energy-work-based numerical manifold seepage analysis with an efficient scheme to locate the phreatic surface, *International Journal for Numerical and Analytical Methods in Geomechanics* (online available), DOI: 10.1002/nag.2280.

J8. Wainwright, H.M., S. Finsterle, Y. Jung, **Q. Zhou**, J.T. Birkholzer, 2014. Making sense of global sensitivity analysis, *Computers & Geoscience*, 65, 84-94, doi: 10.1016/j.cageo.2013.06.006. [SCI Citations: 1]

J9. Cihan, A., **Q. Zhou**, J.T. Birkholzer, S.R. Kraemer, 2014. Flow in horizontally anisotropic multilayered aquifer systems with leaky wells and aquitards, *Water Resources Research*, 50, 741-747, doi: 10.1002/2013WR013867.

J10. Cihan, A., J.T. Birkholzer, T.H. Illangasekare, and **Q. Zhou**, 2014. A theoretical approach representing hysteretic capillary pressure-saturation relationship based on fluid connectivity in void space, *Water Resources Research*, 50, 119-131, doi: 10.1002/2013WR014280.

J11. Liu, X., **Q. Zhou**, P.K. Kitanidis, J.T. Birkholzer, 2014. Fast iterative implementation of large-scale nonlinear geostatistical inverse modeling, *Water Resources Research*, 50, 198-207, doi: 10.1002/2012WR013241.

J12. Chen, F., B. Wiese, **Q. Zhou**, M.B. Kowalsky, B. Norden, T. Kempka, and J.T. Birkholzer, 2014. Numerical modeling of the pumping tests at the CO_2 pilot site in Ketzin, Germany: Model calibration and heterogeneity effects, *International Journal of Greenhouse Gas Control*, 22, 200-2012. [SCI Citations: 0]

J13. Jung, Y., **Q. Zhou**, and J.T. Birkholzer, 2013. Early detection of brine and CO_2 leakage through abandoned wells using pressure and surface-deformation monitoring data: Concept and demonstration, *Advances in Water Resources*, 62, 555-569, doi:10.1016/j.advwatres.2013.06.008. [SCI Citations: 2]

J14. Liu, X., **Q. Zhou**, and J.T. Birkholzer, W.A. Illman, 2013. Geostatistical reduced-order models in under-determined inverse problems, *Water Resources Research*, 49(10), 6587–6600, doi:10.1002/wrcr.20489. . [SCI Citations: 0]

J15. Birkholzer, J.T., J.P. Nicot, C.M. Oldenburg, **Q. Zhou**, S. Kraemer, K. Bandilla, 2013. Reply to comments by Schnaar et al. on "Brine flow up a well caused by pressure perturbation from geologic carbon sequestration: static and dynamic Evaluations" by Birkholzer et al. (2011), *International Journal of Greenhouse Gas Control*, 17, 544–545.

J16. Wainwright, H., S. Finsterle, **Q. Zhou** and J.T. Birkholzer, 2013. Modeling the performance of large-scale CO_2 storage systems: A comparison of different sensitivity analysis methods, *International Journal of Greenhouse Gas Control*, 17, 189–205. [SCI Citations: 2]

J17. Chang, C., **Q. Zhou**, L. Xia, X. Li, and Q. Yu, 2013. Dynamic displacement and non-equilibrium dissolution of supercritical CO_2 in low-permeability sandstone: An experimental study, *International Journal of Greenhouse Gas Control* 14, 1-14. [SCI Citations: 1]

J18. Cihan, A., J.T. Birkholzer, and **Q. Zhou**, 2013. Pressure buildup and brine migration in CO_2 storage systems with multiple leakage pathways: Application of a new analytical solution, *Ground Water*, 51(2), 252–267, doi: 10.1111/j.1745-6584.2012.00972.x. [SCI Citations: 7]

J19. Birkholzer, J.T., A. Cihan, **Q. Zhou**, 2012. Impact-driven pressure management via targeted brine extraction – Conceptual studies of CO_2 storage in saline formations, *International Journal of Greenhouse Gas Control*, 7(March), 168-180, doi:10.1016/j.ijggc.2012.01.001. [SCI Citations: 11]

J20. Cihan, A., **Q. Zhou**, and J. T. Birkholzer, 2011. Analytical solutions for pressure perturbation and fluid leakage through aquitards and wells in a multilayered system, *Water Resources Research*, 47, W10504, doi:10.1029/2011WR010721. [SCI Citations: 13]

J21. Birkholzer, J.T., J.-P. Nicot, C. M. Oldenburg, **Q. Zhou**, S. Kraemer, K. Bandilla, 2011. Brine flow up a well caused by pressure perturbation from geologic carbon sequestration: Static and dynamic evaluations, *International Journal of Greenhouse Gas Control* 5(4), 850-861, doi:10.1016/j.ijggc.2011.01.003. [LBNL-4864E, SCI Citations: 26]

J22. **Zhou, Q.**, and J. T. Birkholzer, 2011. On scale and magnitude of pressure build-up induced by large-scale geologic storage of CO_2, *Greenhouse Gases: Science and Technology* 1, 11-20, DOI: 10.1002/ghg3.001. [LBNL-4898E, SCI Citations: 19]

J23. **Zhou, Q.**, J. T. Birkholzer, and C.-F. Tsang, 2011. Reply to Comments by Veling on "A Semi-Analytical Solution for Large-Scale Injection-Induced Pressure Perturbation and Leakage in a Laterally Bounded Aquifer-Aquitard System" by Zhou, Birkholzer, and Tsang, *Transport in Porous Media* 86, 357-358. [LBNL-4896E]

J24. **Zhou, Q.**, J. T. Birkholzer, E. Mehnert,Y.-F. Lin, and K. Zhang, 2010. Modeling basin- and plume-scale processes of CO_2 storage for full-scale deployment, *Ground Water*, 48(4), 494-514. [LBNL-2788E, SCI Citations: 33]

J25. Birkholzer, J.T., and **Q. Zhou**, 2009. Basin-scale hydrogeologic impacts of CO_2 storage: Regulatory and capacity implications, *International Journal of Greenhouse Gas Control* 3 (6), 745–756 [LBNL-1716E, SCI Citations: 67].

J26. **Zhou, Q.**, S. McCraven, J. Garcia, M. Gasca, T. A. Johnson, and W. Motzer, 2009. Field evidence of biodegradation of N-Nitrosodimethylamine (NDMA) in groundwater with incidental and active recycled water recharge, *Water Research* 43(3), 793-805 [SCI Citations: 20].

J27. **Zhou, Q.**, J. T. Birkholzer, and C.-F. Tsang, 2009. A semi-analytical solution for large-scale injection-induced pressure perturbation and leakage in a laterally bounded aquifer-aquitard system, *Transport in Porous Media*, 78(1), 127-148. [LBNL-1021E, SCI Citations: 13]

J28. Birkholzer, J.T., **Q. Zhou**, and C.-F. Tsang, 2009. Large-scale impact of CO_2 storage in deep saline aquifers: A sensitivity study on pressure response in stratified systems, *International Journal of Greenhouse Gas Control* 3, 181-194. [LBNL-1252E, SCI Citations: 113]

J29. **Zhou, Q.**, J. T. Birkholzer, C.-F. Tsang, and J. Rutqvist, 2008. A method for quick assessment of CO_2 storage capacity in closed and semi-closed saline aquifers, *International Journal of Greenhouse Gas Control* 2, 626-639. [LBNL-63820, SCI Citations: 107]

J30. Guan, J., F. J. Molz, **Q. Zhou,** H.-H. Liu, and C. Zheng, 2008. Behavior of the mass transfer coefficient during the MADE-2 experiment: New insights, *Water Resources Research* 44, W02423, doi:10.1029/2007WR006120. [LBNL-63023, SCI Citations: 12]

J31. Su, G.W., J. Jasperse, D. Seymour, J. Constantz, and **Q. Zhou**, 2007. Simulation analysis of pumping-induced unsaturated regions beneath a perennial river, *Water Resources Research* 43, W08421, doi:10.1029/2006WR005389. [LBNL-63048, SCI Citations:13]

J32. **Zhou, Q.**, H.-H. Liu, F. J. Molz, Y. Zhang, and G. S. Bodvarsson, 2007. Field-scale effective matrix diffusion coefficient for fractured rock: Results from literature survey, *Journal of Contaminant Hydrology* 93, 161–187. [LBNL-57368, SCI Citations: 32]

J33. Liu, H.-H., Y. Zhang, **Q. Zhou,** and F. J. Molz, 2007. An interpretation of potential scale dependence of the effective matrix diffusion coefficient, *Journal of Contaminant Hydrology* 90, 41-57. [LBNL-60744, SCI Citations: 19]

J34. Zhang, Y., H.-H. Liu, **Q. Zhou**, and S. Finsterle, 2006. Effects of diffusive property heterogeneity on effective matrix diffusion coefficient for fractured rock, *Water Resources Research* 42, W04405, doi:10.1029/2005WR004513. [LBNL-58695, SCI Citations: 6]

J35. **Zhou, Q.**, H.-H. Liu, G. S. Bodvarsson, and F. J. Molz, 2006a. Evidence of multi-process matrix diffusion in a single fracture from a field tracer test, *Transport in Porous Media* 63(3), 473–487. [LBNL-58198, SCI Citations: 16]

J36. **Zhou, Q.**, R. Salve, H.-H. Liu, J. Wang, and D. Hudson, 2006b. Analysis of a meso-scale infiltration and water seepage test in unsaturated fractured rock: Spatial variabilities and discrete fracture patterns, *Journal of Contaminant Hydrology* 87, 96-122. [LBNL-55489, SCI Citations: 7]

J37. **Zhou, Q.**, J. Bear, and J. Bensabat, 2005. Saltwater upconing and decay beneath a well pumping above an interface zone, *Transport in Porous Media* 61(3), 337-363. [LBNL-55486, SCI Citations: 15]

J38. **Zhou, Q.**, J. T. Birkholzer, I. Javandel, and P. D. Jordan, 2004. Modeling three-dimensional groundwater flow and advective contaminant transport at a heterogeneous mountainous site in support of remediation, *Vadose Zone Journal* 3, 884–900. [LBNL-54318, SCI Citations: 3]

J39. **Zhou, Q.**, H.-H. Liu, G. S. Bodvarsson, and C. M. Oldenburg, 2003. Flow and transport in unsaturated fractured rocks: Effects of multiscale heterogeneity of hydrogeologic properties, *Journal of Contaminant Hydrology* 60 (1-2), 1-30. [SCI Citations: 23]

J40. **Zhou, Q.**, J. Bensabat, and J. Bear, 2001. Accurate calculation of specific discharge in heterogeneous porous media, *Water Resources Research* 37(12), 3057-3069. [SCI Citations: 4].

J41. Bensabat, J., **Q. Zhou**, and J. Bear, 2000. An adaptive pathline-based particle tracking algorithm for the Eulerian-Lagrangian method, *Advances in Water Resources* 23(4), 383-397. [SCI Citations: 22]

J42. Zhu, Y., and **Zhou, Q**., 1995. Risk analysis of flood control benefits of the Three-Gorge Project, *J. of Advances in Water Sciences (in Chinese)* 6(1), 29-35.

5.2 Book Chapters

B1. Karsten Pruess, Jens T. Birkholzer, and **Quanlin Zhou**, 2011. Mathematical models as tools for probing long-term safety of CO_2 storage, in *Developments and Innovation in Carbon Capture and Storage* (CCS) Technology (Maroto-Valer, M.M., ed.), Woodhead Publishing, Cambridge, UK (in press).

B2. Jacob Bear and **Quanlin Zhou**, 2007. Sea water intrusion into coastal aquifers, Chapter 12 in *the Handbook of Groundwater Engineering, Second Edition*, Jacques Delleur (editor), CRC Press, Taylor & Francis Group, Boca Raton, Florida. (LBNL-63047)

B3. Hui-Hai Liu, Jonny Rutqvist, **Quanlin Zhou,** and Gudmundur S. Bodvarsson, 2004. Upscaling of normal stress-permeability relationships for fracture networks obeying fractional Levy motion, in *Elsevier Geo-Engineering Book Series Volume II, Coupled Thermo-Hydro-Mechanical-Chemical Processes in Geo-Systems: Fundamentals, Modeling, Experiments and Applications*, by Stephansson, O., Hudson, J. A., Jing, L. (editors), Oxford, p. 263–268.

5.3 Conference Papers

C1. **Q. Zhou**, 2014 (Keynote talk). Multiple flow paths of CO2 migration revealed from field monitoring of Frio I Pilot test and Cranfield large-scale demonstration project: Potential applications of stochastic joint inversion, presented at the EU-FP7 Funded PANACEA Consortium Meeting, March 31st -- April 1st, 2014, Trondheim, Norway.

C2. Wainwright, H.M., S. Finsterle, Q. Zhou and J.T. Birkholzer, 2013. Improved understanding of global sensitivity analysis: Applications to CO2 storage systems, MODFLOW *and More 2013: Translating Science into Practice*, June 2-5, Colorado School of Mines, Golden, CO.

C3. Liu X., Q. Zhou, J.T. Birkholzer, 2013. Aquifer characterization with hydraulic tomography and geostatistical inversion, *12th Annual Conference on Carbon Capture Utilization & Sequestration*, May 13 - 16, 2013, Pittsburgh, Pennsylvania.

C4. Chen, F., Q. Zhou, J.T. Birkholzer, 2013. Modeling pumping and CO2 injection tests at Ketzin site: Heterogeneity effects and model calibration, *12th Annual Conference on Carbon Capture Utilization & Sequestration*, May 13 - 16, 2013, Pittsburgh, Pennsylvania.

C5. Wainwright, H.M., S. Finsterle, Y. Jung, **Q. Zhou**, J.T. Birkholzer, 2012. iTOUGH2 global sensitivity analysis module: Application to CO_2 storage systems, *Proceedings of TOUGH Symposium 2012*, September 17-19, 2012, Berkeley, CA.

C6. Jung, Y., **Q. Zhou**, and J. T. Birkholzer, 2012. Impact of data uncertainty on identifying leakage pathways in CO_2 geologic storage and estimating hydrogeological properties by inverse modeling, *Proceedings of TOUGH Symposium 2012*, September 17-19, 2012, Berkeley, CA.

C7. Chen, F., **Q. Zhou**, and J. T. Birkholzer, 2012. TOUGH2 Simulation of the pumping tests at Ketzin site: Heterogeneity effects and model calibration, *Proceedings of TOUGH Symposium 2012*, September 17-19, 2012, Berkeley, CA.

C8. Rebscher, D., **Q. Zhou**, and J. T. Birkholzer, 2012. Simulation of CO_2 storage in the Basal aquifer in the Northern Plains – Prairie region of North America, *Proceedings of TOUGH Symposium 2012*, September 17-19, 2012, Berkeley CA.

C9. Wainwright, H.M., S. Finsterle, **Q. Zhou**, J.T. Birkholzer, 2012 (Talk). Uncertainty quantification of the CO2 storage system for a hypothetical GCS project in the southern San Joaquin Basin in California, *Computational Methods in Water Resources XIX International Conference*, June 17-21, 2012 in Urbana, Illinois, USA.

C10. Birkholzer, J.T., A. Cihan, **Q. Zhou**, 2012 (Talk). Impact-driven pressure management via targeted brine extraction – Conceptual studies of CO2 storage in saline formations, *the 11th Annual Conference on Carbon Capture Utilization& Sequestration*, April 30 - May 3, 2012, Pittsburgh, Pennsylvania.

C11. Jung, Y., **Q. Zhou**, and J.T. Birkholzer, 2012. Early detection of brine or CO2 leakage through high-permeability pathways using pressure-based observation data, *the11th Annual Conference on Carbon Capture Utilization& Sequestration*, April 30 - May 3, 2012, Pittsburgh, Pennsylvania.

C12. Illangasekare, T.H., Plampin, M., Trevisan, L., Agartan, E, H.Mori, Sakaki, T., Cihan, A., Birkholzer, J., **Zhou, Q.,** R. Pawar and G. Zyvoloski, 2012 (Talk). Multiple scale physical and numerical modeling for improved understanding of mechanisms of trapping and leakage of CO2 in deep geologic formations, *the EGU General Assembly 2012*, Vienna, Austria.

C13. Trevisan, L.,Illangasekare, T.H., Rodriguez, D., Sakaki, T., Cihan, A., Birkholzer, J.T., and **Zhou, Q.**, 2011. Improved understanding of migration and entrapment of supercritical CO_2 in deep geologic formations: Intermediate-scale testing and modeling, *The MODFLOW and More 2011: Integrated Hydrologic Modeling*, Golden, CO, June 5-8, 2011.

C14. Murakami, H., S. Finsterle, **Q. Zhou**, J.T. Birkholzer, 2011. Uncertainty quantification and global sensitivity analysis of CO2 migration and pressure buildup for a hypothetical GCS project in the Southern San Joaquin Basin in California, *The Tenth Annual Carbon Capture & Sequestration*, May 2-5, Pittsburgh, PA.

C15. Cihan, A., **Q. Zhou**, J.T. Birkholzer, 2011, Analytical solutions for leakage through aquitards and abandoned wells in multilayered aquifer-aquitard systems, *The Tenth Annual Carbon Capture & Sequestration*, May 2-5, Pittsburgh, PA.

C16. Birkholzer, J.T., J.P. Nicot, C.M. Oldenburg, **Q. Zhou**, S. Kraemer, K. Bandilla, 2011. Brine leakage up a well caused by pressure perturbation from CO2 injection: A discussion of threshold pressures, flow rates, and environmental impact, *The Tenth Annual Carbon Capture & Sequestration*, May 2-5, 2011, Pittsburgh, PA.

C17. Illangasekare, T.H., Trevisan, L., Rodriguez, D., Sakaki, T., Cihan, A., Birkholzer, J.T., and **Zhou, Q.**, 2011. A fundamental study of migration and entrapment of supercritical CO_2 in heterogeneous deep geologic formations: Intermediate-scale testing and modeling, *the EGU 2011 Meeting*, Vienna, Austria, April 10-14, 2011.

C18. Birkholzer, J.T., **Q. Zhou,** L. Zheng, and N. Spycher, 2011. CO_2 geological storage and groundwater resources: Model applications, *the 2011 SIAM Conference on Mathematical and Computational Issues in Geosciences*, Long Beach, CA, March 21-24, 2011.

C19. Birkholzer, J.T., **Q. Zhou**, A. Cortis, and S. Finsterle, 2010 (Talk). A sensitivity study on regional pressure buildup from large-scale CO_2 storage projects, *the 10th International Conference on Greenhouse Gas Control Technologies (GHGT-10)*, Sept 19-23, 2010, Amsterdam, the Netherland.

C20. **Quanlin Zhou**, Jens T. Birkholzer, and Jeffrey L. Wagoner, 2010 (Talk). Modeling the potential impact of geologic carbon sequestration in the southern San Joaquin basin, California, *The Ninth Annual Carbon Capture & Sequestration*, May 10-13, Pittsburgh, PA

C21. **Quanlin Zhou** and Jens T. Birkholzer, 2010. The secondary seal effect on CO_2 plume development and migration in a sedimentary basin, *Caprocks and Seals for Geologic Carbon Sequestration*, January 12 to 15, 2010, Pacific Grove, CA.

C22. Jens T. Birkholzer and **Quanlin Zhou**, 2010. Large-scale impact of CO_2 storage in deep saline aquifers: The importance of caprock permeability, *Caprocks and Seals for Geologic Carbon Sequestration*, January 12 to 15, 2010, Pacific Grove, CA.

C23. Jens T. Birkholzer and **Quanlin Zhou**, 2009. An Integrated Model for Basin- and Plume-scale Processes Related to Full-Scale Employment of CO_2 Storage – The Illinois Basin as an Example, Extended Abstract, *AAPG/SEG/SPE Hedberg Conference on Geological Carbon Sequestration: Prediction and Verification*, Vancoucer, BC, Canada, August 16-19, 2009.

C24. **Quanlin Zhou,** Jens T. Birkholzer, Hannes Leetaru, Edward Mehnert, Yu-Feng Lin, 2009 (Talk). Integrated modeling of basin-scale impacts on groundwater resources and plume-scale transport behavior of geologic carbon sequestration in the Illinois sedimentary basin, *the 7th International Conference on Calibration and Reliability in Groundwater Modeling, Managing Groundwater and the Environment*, September 20-23, 2009, Wuhan, China.

C25. **Quanlin Zhou**, Jens T. Birkholzer, Edward Mehnert, and Yu-Feng Lin, 2009 (Talk). Basin-scale hydrological impact of geologic carbon sequestration in the Illinois Basin: A full-scale deployment scenario, *Water/Energy Sustainability Symposium at the 2009 Groundwater Protection Council Annual Forum*, September 13 to 16, Salt Lake City, Utah.

C26. **Quanlin Zhou**, Lehua Pan, James Hylen, Byron G. Lundberg, Robert K. Plunkett, Stephen H. Pordes, and Stefan A. Finsterle, 2009. Modeling of multiphase diffusive processes of tritium in an underground accelerator facility, *TOUGH Symposium 2009*, Berkeley, CA, September 14-16, 2009.

C27. Jens T. Birkholzer, and **Quanlin Zhou**, 2009. Integrated modeling of basin- and plume-scale processes related to geologic carbon sequestration in the Illinois Basin, *TOUGH Symposium 2009*, Berkeley, CA, September 14-16, 2009.

C28. **Quanlin Zhou**, Jens T. Birkholzer, Hannes Leetaru, Edward Mehnert, Yu-Feng Lin, 2009 (Invited Talk). Basin-scale environmental impact of geologic carbon sequestration: evaluation of a hypothetical scenario for full-scale deployment in the Illinois Basin, *The American Water Works Association (AWWA) Annual Meeting* in San Diego, CA, June 14-18, 2009.

C29. Jens T. Birkholzer and **Quanlin Zhou**, 2009 (Talk). Basin-scale hydrological impacts of multiple-site CO_2 storage in the Illinois Basin: Regulatory and capacity implications, *The Eighth Annual Conference on Carbon Capture & Sequestration*, Pittsburgh, PA, May 4-7, 2009.

C30. **Quanlin Zhou**, Jens T. Birkholzer, Hannes Leetaru, Edward Mehnert, Yu-Feng Lin, Chin-Fu Tsang, Preston Jordan, Scott Frailey, and Robert Finley, 2009 (Talk). Integrated modeling of basin-scale and plume-scale processes related to geologic carbon sequestration in the Illinois Basin, *The Eighth Annual Conference on Carbon Capture & Sequestration*, Pittsburgh, PA, May 4-7, 2009.

C31. **Quanlin Zhou**, Jens T. Birkholzer, Hannes Leetaru, Edward Mehnert, Chin-Fu Tsang, Scott Frailey, and Robert Finley, 2009 (Invited Talk). Basin-scale environmental impact of geologic

carbon sequestration in the Illinois Basin, *the Symposium of Carbon Sequestration— Moving Carbon from the Atmosphere to the Lithosphere, in the 42nd Annual Meeting of the North-Central Section of the Geological Society of Americ*a, April 2-3, 2009, Rockford, Illinois, USA.

C32. **Quanlin Zhou**, Jens T. Birkholzer, Chin-Fu Tsang, Hannes Leetaru, Edward Mehnert, Keni Zhang, Preston Jordan, Scott Frailey, and Robert Finley, 2008. Modeling of basin-scale pressure perturbations induced by geological carbon sequestration in a sedimentary basin, *the Virtual Conference on Climate Change and CO_2 Storage*, December 3rd, 2008, Imperial College, London.

C33. Monica Gasca, Theodore Johnson , Sally McCraven , **Quanlin Zhou** , Julio Garcia, 2008. Natural photolysis and biodegradation of NDMA at groundwater recharge facilities that use recycled water, Los Angeles County, California, *The 21st Symposium of Groundwater Resources Association of California on Emerging Contaminants 2008*, San Jose, CA, November 19-20, 2008.

C34. Hannes Leetaru, Scott Frailey, James Damico, Edward Mehnert, Jens Birkholzer, **Quanlin Zhou**, and Preston Jordan, 2008. Understanding CO_2 plume behavior during sequestration projects through the use of reservoir fluid modeling, *9th International Conference on Greenhouse Gas Technologies*, Washington DC, November 16-20, 2008.

C35. **Quanlin Zhou**, Jens T. Birkholzer, Chin-Fu Tsang, 2008. Environmental impact of large-scale CO_2 injection and storage in a multi-sequence aquifer-seal system: pressure propagation and brine displacement, *The Seventh Annual Conference on Carbon Capture & Sequestration*, Pittsburgh, PA, May 5-8, 2008.

C36. Sally McCraven, Phyllis Stanin, **Quanlin Zhou**, 2008 (Talk). Occurrence, fate, and transport of N-Nitrosodimethylamine (NDMA) in California Groundwater, *Sixth International Conference on Remediation of Chlorinated and Recalcitrant Compounds*, Monterey, CA, May 19-22, 2008.

C37. Sally McCraven, **Quanlin Zhou**, Julio Garcia, Monica Gasca, and Ted Johnson, 2008 (Talk). Characterizing field biodegradation of N-Nitrosodimethylamine (NDMA) in groundwater near reclaimed water recharge areas, *Annual California WateReuse Conference*, Newport Beach, CA, March 24-26, 2008.

C38. **Quanlin Zhou**, Jens Birkholzer, Jonny Rutqvist, and Chin-Fu Tsang, 2007 (Talk). Sensitivity study of CO_2 storage capacity in brine aquifers with closed boundaries: Dependence on hydrogeologic properties, *Sixth Annual Conference on Carbon Capture & Sequestration*, Pittsburgh, PA, May 7-10, 2007.

C39. Jacob Bensabat, Jacob Bear, and **Quanlin Zhou**, 2006. Large scale modeling of seawater intrusion in a coastal aquifer: Application to the North Sharon and Heffer Valley areas, Israel, *CMWR XVI - Computational Methods in Water Resources, XVI International Conference*, Copenhagen, Denmark, June 19-22, 2006.

C40. **Quanlin Zhou**, 2006. Validation of the active fracture model for unsaturated fracture flow using numerical experiments, in *Proceedings of TOUGH Symposium 2006*, Berkeley, CA, May 15-17, 2006.

C41. **Quanlin Zhou**, Jens T. Birkholzer, Iraj Javandel, and Preston D. Jordan, 2003. Simulation of groundwater flow at the LBNL site using TOUGH2, in *Proceedings of TOUGH Symposium 2003*, Berkeley, California, May 12-14, 2003.

C42. **Quanlin Zhou**, Gudmundur S. Bodvarsson, Hui-Hai Liu, and Curtis M. Oldenburg, 2002 (Talk). Characterization of spatial variability of hydrogeologic properties for the unsaturated flow in the fractured rocks at Yucca Mountain, Nevada, in *Proceedings of the International Groundwater Symposium on Bridging the Gap between Measurements and Modeling in Heterogeneous Media*, Berkeley, California, March 25-29, 2002.

C43. **Quanlin Zhou**, Lynn W. Gelhar, and Bruce Jacobs, 2002 (Talk). Comparison of the field-scale effective properties of two-phase flow in heterogeneous porous media obtained by stochastic analysis and numerical experiments, in *Proceedings of the International Groundwater Symposium on Bridging the Gap between Measurements and Modeling in Heterogeneous Media*, Berkeley, California, March 25-29, 2002.

C44. Jacob Bear, **Quanlin Zhou**, and Jacob Bensabat, 2001 (Talk). Three-dimensional simulation of seawater intrusion in heterogeneous aquifers: Application to the coastal aquifer of Israel, in *Proceedings of the First International Conference on Saltwater Intrusion and Coastal Aquifers-Monitoring, Modeling, and Management*, Essaouira, Morocco, April 23-25, 2001.

C45. **Quanlin Zhou**, and Yuansheng Zhu, 1993 (Talk). Composite risk analysis for levee of flood plains, in *Proceedings of South and East Asia Regional Symposium on Tropic Storms and Related Flood*, 139-146, Guangzhou, China, November 22-25, 1993.

5.4 Presentations with Abstracts in Conferences and Professional Meetings

1. Liu, X., **Q. Zhou**, P.K. Kitanidis, and Jens T. Birkholzer 2012 (Talk). Fast iterative implementation of nonlinear geostatistical inverse modeling, Abstract in Proceedings AGU Fall Meeting 2012, San Francisco, CA, December, 2012.
2. Jung,Y., **Q. Zhou**, and J.T. Birkholzer, 2012 (Talk). Early detection of brine and CO2 leakage through abandoned wells using pressure and surface deformation monitoring data, Abstract in Proceedings AGU Fall Meeting 2012, San Francisco, CA, December, 2012.
3. Birkholzer J.T., and **Zhou Q.**, 2010 (Invited Talk). On Regional Pressure Buildup and Fluid Migration in Response to Large CO2 Injection Operations, Abstract in Proceedings to 2010 GSA Annual Meeting, Denver, Colorado, October 31 to November 3, 2010.
4. Cihan A., Illangasekare T.H**.**, **Zhou Q.**, Birkholzer J.T., and Rodriguez D., 2010. Intermediate-scale investigation of capillary and dissolution trapping during CO2 injection and post-injection in heterogeneous geologic formations, Abstract in Proceedings AGU Fall Meeting 2010, San Francisco, CA, December, 2010.
5. **Zhou Q.**, and Birkholzer J.T., 2010 (Talk). The Role of Fault Zones in Capillary and Dissolution Trapping of CO2 in the Southern San Joaquin Basin, California, Abstract in Proceedings to AGU Fall Meeting 2010, San Francisco, CA, December, 2010.
6. **Quanlin Zhou**, Fred J. Molz, Hui-Hai Liu, and Yingqi Zhang, 2008 (Talk). Scaling behavior of field-scale diffusive transport in fractured rock and porous media: A contradiction? *EOS Trans. AGU* 89(53), Fall Meet. Suppl. Abstract H31K-04, December 15-19, San Francisco, CA.
7. Jens T. Birkholzer, **Quanlin Zhou**, Preston Jordan, Chin-Fu Tsang, Hannes Leetaru, Edward Mehnert, Scott Frailey, and Robert Finley, 2008 (Talk). A hypothetical scenario for full-scale deployment of geological carbon sequestration: Investigating the interaction between multiple CO_2

storage sites in a sedimentary basin, *EOS Trans. AGU* 89(53), Fall Meet. Suppl. Abstract H12C-02, December 15-19, San Francisco, CA.

8. **Quanlin Zhou**, Jens Birkholzer, Chin-Fu Tsang, Jonny Rutqvist , 2007. Quick assessment of CO_2 storage capacity in pressure-constrained saline aquifers with different hydrogeologic properties. H13F-1662, AGU Fall Meeting, December 10-14, San Francisco, CA
9. Chin-Fu Tsang, Jens Birkholzer, **Quanlin Zhou**, 2007. Pressure propagation and brine displacement in CO_2 storage formations: The role of sealing units. H13F-1661, AGU Fall Meeting, December 10-14, San Francisco, CA.
10. Sally McCraven, **Quanlin Zhou**, Julio Garcia, Monica Gasca, and Ted Johnson, 2007. Characterizing field biodegradation of N-nitrosodimethylamine (NDMA) in groundwater with active recycled water recharge. H33E-1696, AGU Fall Meeting, December 10-14, 2007, San Francisco, CA.
11. Yingqi Zhang, Hui-Hai Liu, Stefan Finsterle, and **Quanlin Zhou**, 2005. How dual-scale diffusive property heterogeneity affects the effective matrix diffusion coefficient in fractured rock. AGU Fall Meeting, December 5-9, 2005, San Francisco, CA
12. **Quanlin Zhou**, Jens T. Birkholzer, Iraj Javandel, and Preston D. Jordan, 2004. Refining a three-dimensional groundwater flow model at a heterogeneous site in support of remediation. H11C-0316, AGU Fall Meeting, December 13–17, 2004, San Francisco, CA.
13. **Quanlin Zhou**, Gudmundur S. Bodvarsson, Hui-Hai Liu, and Curtis M. Oldenburg, 2001. Calibration of spatial variability of hydrogeologic properties in the unsaturated fractured rock at Yucca Mountain, Nevada. H31C-0259, AGU Fall Meeting, December 10–14, 2001, San Francisco, CA.

5.5 Seminars by Quanlin Zhou

1. Four Unresolved Questions in Monitoring Data from CO2 Injection-Storage Sites: Some Modeling Studies and Discussions, Presented at Uppsala University, Uppsala, Sweden, April 3, 2014,
2. Basin-Scale Modeling of CO2 Injection and Storage in Brine Formations: Analytical and Numerical Modeling with Applications, Presented at Uppsala University, Sweden, April 2, 2014
3. Science and Technology Challenges in Geologic Carbon Sequestration (GCS): Storage Capacity, Heterogeneity Effects, and Monitoring and Leakage Detection, at Beijing Normal University, Beijing, January 10, 2011.
4. Overview of Geologic Carbon Sequestration in the United States: Update and Challenges, at the Institute of Geology and Geophysics, China Academy of Sciences, Beijing, January 5, 2011
5. TOUGH2 Modeling for Geologic Carbon Sequestration: Fundamentals and Application to the Southern San Joaquin Basin, California, at the Institute of Geology and Geophysics, China Academy of Sciences, Beijing, January 5, 2011.
6. Data Analysis of the Frio Brine Pilot Tests: Characterizing Multiscale Heterogeneity and Evaluating its Effects on CO2 Storage, at the Institute of Geology and Geophysics, China Academy of Sciences, Beijing, January 5, 2011.
7. Science and Technology Challenges in Geologic Carbon Sequestration (GCS): Storage Capacity, Heterogeneity Effects, and Monitoring and Leakage Detection, at China University of Geosciences, Beijing, January 4, 2011.

8. Modeling Geologic Carbon Sequestration (GCS) and Some Thoughts on Pressure-Driven Geomechanical Processes, at the Geotechnical Institute, Hohai University, Nanjing, China, October 15, 2009.
9. Climate Change and U.S. Energy Research: The Role of Carbon Capture and Sequestration, at the Research Center for Climate Change, the Ministry of Water Resources, Nanjing Hydraulic Research Institute, Nanjing, China, October 14, 2009.
10. Climate Change and U.S. Energy Research: The Role of Carbon Capture and Sequestration, at the Key State Laboratory of Water Resources and Hydraulic Engineering, Hohai University, Nanjing, China, October 13, 2009.
11. Geologic Carbon Sequestration (GCS) in the Illinois Basin: From Site Characterization to Full-Scale Deployment, at the Institute of Geology and Geophysics, China Academy of Sciences, Beijing, China, September 29, 2009.
12. Geologic Carbon Sequestration (GCS) in the Illinois Basin: From Site Characterization to Full-Scale Deployment, at the Institute of Rock and Soil Mechanics, China Academy of Sciences, Wuhan, China, September 22, 2009.
13. Numerical investigation of multiphase flow and transport in heterogeneous porous and fractured media, at Lawrence Livermore National Laboratory, April 2002.
14. Numerical investigation of field-scale effective properties of two-phase flow in heterogeneous porous media, at Lawrence Berkeley National Laboratory, September 2001.
15. Numerical investigation of effective properties of multiphase flow in heterogeneous porous media, at Massachusetts Institute of Technology, September 2000.
16. Modeling of strongly density-dependent flow and transport problems, at Massachusetts Institute of Technology, April 2000.
17. Modeling of strongly density-dependent flow and transport problems, at the University of Texas at Austin, March 2000.
18. Modeling seawater intrusion in coastal aquifers, at the Technion-Israel Institute of Technology, Haifa, Israel, June 1999.